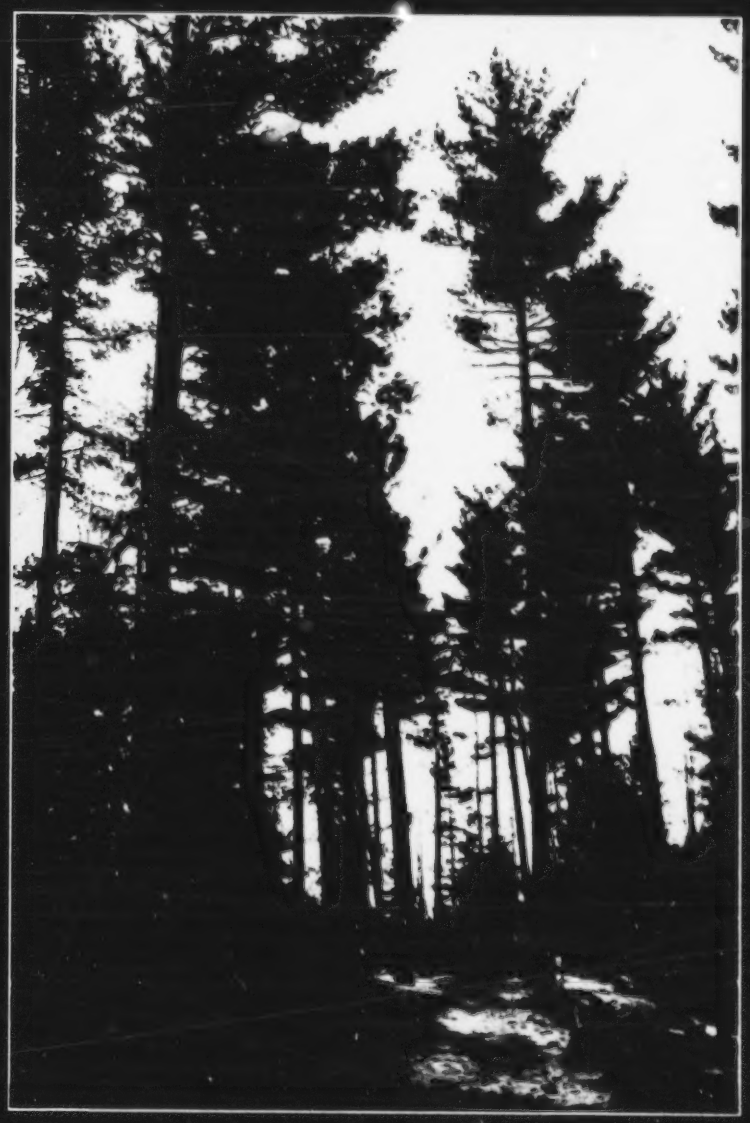
Government of Canada | Gouvernement du Canada
Canadian Forestry Service | Service canadien des forêts

In Praise of Pine

P.L. Aird

Information Report PI-X-52
Petawawa National Forestry Institute



86-06379/

PETAWAWA NATIONAL FORESTRY INSTITUTE

In common with the rest of the Canadian Forestry Service, the Petawawa National Forestry Institute has as its objective the promotion of better management and wiser use of Canada's forest resource to the economic and social benefit of all Canadians. Objectives of program activities carried out at the Institute support this goal through discovery, development, demonstration, implementation, and transfer of innovations. Because it is a national institute, particular emphasis is placed on problems that transcend regional boundaries or that require special expertise and equipment that cannot be duplicated in CFS regional establishments. Such research is often performed in close cooperation with staff of the regional centres or provincial forest services.

Research initiatives and technical services at the Institute encompass six major activities:

FOREST GENETICS AND BIOTECHNOLOGY — Integrates projects in tree genetics, soil microbiology, micropropagation, molecular genetics, and seed research. It also includes the client services and seed bank operations of the National Tree Seed Centre, a long-standing program with extensive international affiliations.

FOREST MANAGEMENT SYSTEMS — This program integrates projects in fire, remote sensing, meteorology, modelling, growth and yield, and FIDS to provide research and development for the formulation and demonstration of forest management systems.

NATIONAL FOREST RESOURCE STATISTICS — Widely known as FORSTATS, this program coordinates the acquisition, standardization, and publication of national statistics on the forests of Canada, and responds to client requests.

FOREST DATA SYSTEMS — Provides the expertise and computer-based systems necessary to manage data acquired through FORSTATS and the research projects at PNFI. Additionally, the program provides informatics advice and service at the CFS corporate level.

COMMUNICATIONS — Integrates activities of the library, public awareness, information, and editing and publications projects. The Institute is visited by more than 20 000 people every year. There is a Visitor Centre for the public, self-guided tours, and an extensive education project. The national repository of all scientific and technical publications of the CFS is at PNFI.

THE RESEARCH FOREST — Besides natural stands manipulated in a variety of ways for silvicultural research, the 98 km^2 Petawawa Forest contains extensive areas of plantations dating back six decades. Research plantations are a source of growth and yield data derived from cultural experiments, and they are becoming valuable for pedigreed genetic materials for micropropagation and molecular genetics studies. The forest also offers opportunities for short- and long-term testing of forest management strategies.

In Praise of Pine:
the eastern white pine and red pine timber harvest from Ontario's Crown forest

*by Paul L. Aird**

Report no. PI-X-52
1985

Canadian Forestry Service

Petawawa National Forestry Institute
Chalk River, Ontario

**Paul Aird is a member of the Faculty of Forestry, University of Toronto, Toronto, Ontario, M5S 1A1, where he teaches and researches forest policy and nature conservation. Professor Aird was under contract with the Canadian Forestry Service for this project.*

©Minister of Supply and Services Canada. 1985
©Ministre des Approvisionnements et Services Canada. 1985

Catalogue No. Fo 46-11/52-1985E
ISSN 0706-1854
ISBN 0-662-14024-9

Additional copies of this publication are available at no charge from
Technical and Scientific Information Distribution Centre
Canadian Forestry Service
Petawawa National Forestry Institute
Chalk River, Ontario
K0J 1J0

Cette publication est aussi disponible en français sous le titre **L'Éloge du Pin.**

Cover Photograph: *Jocko River, Nipissing District, 1912-13. Photographer, W.D. Watt, North Bay. Courtesy, Ontario Archives (Reference S 16941).*

Contents

Map: The range of eastern white pine and red pine in Ontario and Quebec IV

Abstract/Résumé V

Prologue 1

A history of the harvest 3

Measuring the harvest 9

Managing the pine forests 13

References 19

Figures:

1: An account of timber consumed in the United Kingdom from 1788 to 1833, showing the quantities imported from the North American colonies and from Europe 3

2: Annual harvest of white and red pine square timber from Ontario's Crown forest 4

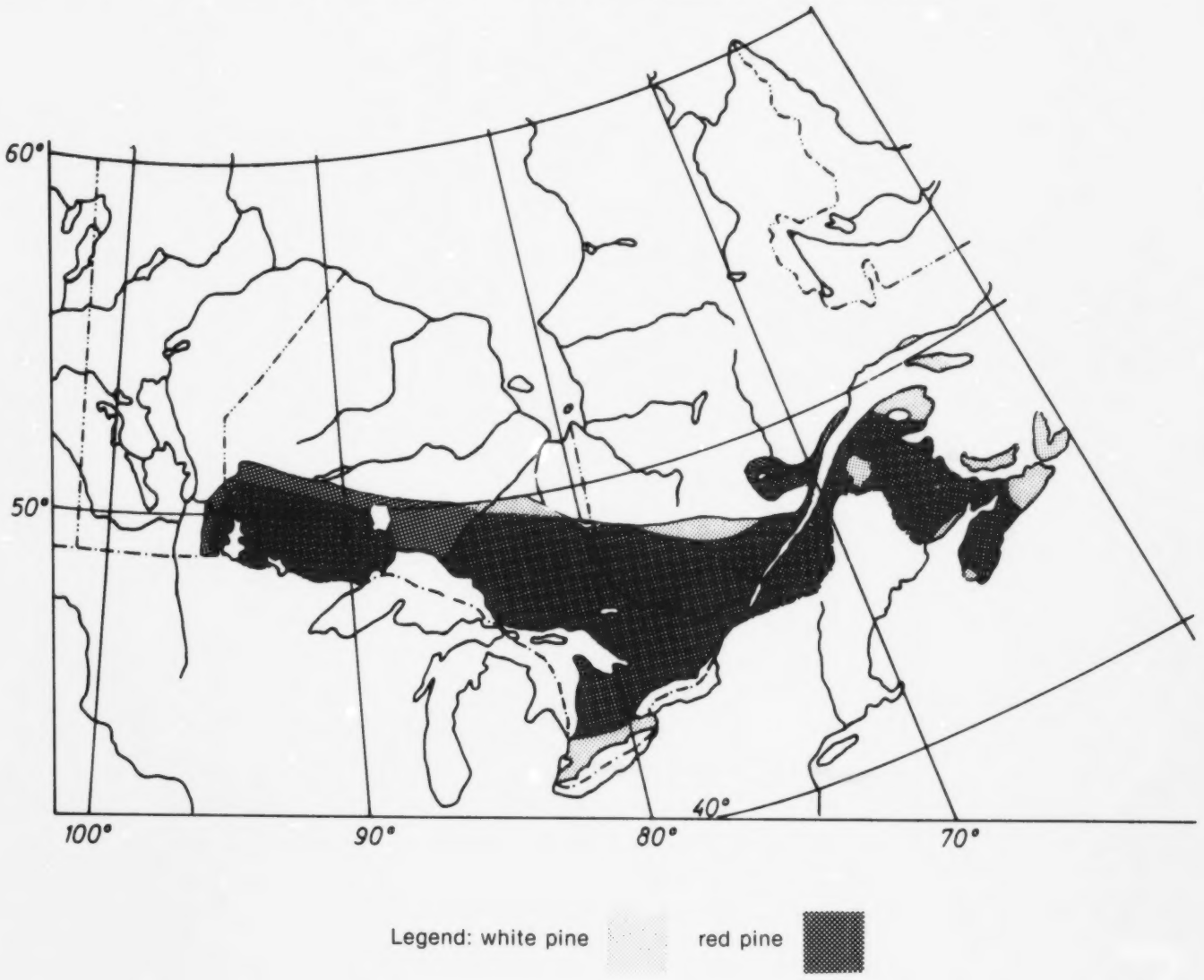
3: Annual harvest of white and red pine square, waney, boom and dimension timber from Ontario's Crown forest . 5

4: Annual harvest of white and red pine sawlogs from Ontario's Crown forest 6

5: Annual harvest of white and red pine timber (square, waney, boom and dimension) and sawlogs from Ontario's Crown forest 6

6: The production of pine sawlogs in Ontario and the export of sawlogs from Ontario to the United States, in relation to the 1898 regulation requiring all logs harvested on Crown lands to be manufactured in Ontario 7

The range of eastern white pine and red pine in Ontario and Quebec (Source: Stiell 1978)



Abstract

The history, statistics, and management of the harvest of eastern white pine and red pine from Ontario's Crown forest is linked to the development of the province. Starting with the shipbuilding industry in New France in the 1700s, through the era of square timber export to Britain and the sawlog trade with the United States, the pine harvest was a contributing factor leading to Confederation. The final decline in the supply and harvest of pine led to serious concerns about the effectiveness of the political effort to sustain this vital resource.

Résumé

L'histoire, les statistiques et la gérance de la récolte du pin blanc de l'est et du pin rouge, des forêts de la Couronne en Ontario, sont reliées au développement de la province. Avec l'industrie navale de la Nouvelle-France, aux alentours de 1700, passant par l'ère de l'exportation de billots équarris vers l'Angleterre et le commerce de billots de scierie avec les États-Unis, la récolte du pin fut un des facteurs qui suscitèrent la Confédération. Le déclin final des réserves et de la récolte du pin occasionna de graves soucis concernant l'efficacité de l'effort politique pour soutenir cette ressource vitale.

Prologue

The history of the province of Ontario is inextricably linked to the harvest of eastern white pine (*Pinus strobus* L.) and red pine (*Pinus resinosa* Ait.). Beginning in the late 1700s, the pine square timber trade forged important commercial and political links, first with Quebec and England, and later with the United States and countries in Europe and South America. This generated the capital and jobs needed to nourish the settlement of Ontario, and ultimately led to the confederation of the provinces.

Over the years, Ontario's pine forests have provided the jobs, products, recreational opportunities, wildlife habitats, clean water and fresh air needed to build the province and the nation.

The wealth of the pine forest reached its peak just prior to 1900 and has diminished steadily ever since. While the peak years of harvest would have been the best time to initiate a pine management program in Ontario, none was forthcoming. The combination of logging, destruction by fire and lack of reforestation resulted in an ever-decreasing supply of a vital resource. People spoke out against the wasteful practices, but their voices were generally ignored. Neither the public nor the politicians were aroused enough to support a comprehensive program of pine management, even as sawmill after sawmill failed.

The excellent statistics on the harvest of eastern white pine and red pine in Ontario may represent the longest continuous record of the harvest of any tree species in North America. Though these data clearly indicate the rise and fall of the pine harvest, reliable information on the impact of fire and on regeneration after logging was missing. The annual harvest had to be compared with the annual allowable cut, and this latter statistic was published only once, in 1963 (Dixon).

These gaps in the information base made it impossible to make a reliable estimate of the growth and depletion of the pine species. For more than a century, each successive government has neglected to provide the data needed to make a full account of how it discharged its responsibility to manage the pine forests on Crown land.

Only a few stands of the "giant pine" remain in Ontario. Some of these are now protected in nature reserves, such as in Algonquin Provincial Park, but even these will fall. It has been predicted (Sheehy 1980) that "Under the current practice with no active management of the reserves (in Algonquin Park), white pine should decline in abundance in the reserves and ultimately may disappear."

Fortunately, eastern white pine and red pine are resilient species. Their range and genetic diversity are intact; they still have the capacity to spring back — to regenerate, grow and flourish in many areas, as in former years. The results of pine management research at the Petawawa National Forestry Institute, the Ontario Tree Improvement and Forest Biomass Institute of the Ontario Ministry of Natural Resources, at universities and elsewhere, have shown that white and red pine can contribute much more to the social, economic and political welfare of the province and Canada.

The former splendor of the eastern white pine and red pine forests can be restored and sustained in many areas, if given the chance. An account of the history, statistics and management of these species is presented to focus on the opportunities that may be realized through better pine management.

Logging white pine, Ottawa Valley

A history of the harvest

The harvest of eastern white pine and red pine from Ontario's Crown forest began with shipbuilding during the French regime in New France (1608-1763). Journeys were made up the St. Lawrence River in search of timber for ship masts, close to water for transportation. In 1742, Intendant Hocquart wrote Governor-General Beauharnois (Archives Nationales Colonies 1742, Lower 1923, 1928) of the finding of a red pine forest above Montreal:

"We are honoured in sharing with you the discovery made last September by Pierre Baron of a pinery of red pine located 30 leagues above Montreal . . . if we are to believe Baron who has been here for a few days the pinery that he has discovered is nearly inexhaustible."

This, and related evidence, point to the beginning of the timber trade in the Lake Ontario region in 1743. The pine was harvested for the masts of "Le Caribou", a warship with 20 guns, which was launched in Quebec in 1744.

When the British regime began in 1763, the first thought of the Home Government was the need to reserve the naval timber. Without a constant supply of large-dimension timber, their sea power and freedom were threatened (Aird 1976). At this time, however, in spite of a century and a half of French occupation and colonization, there was not a single settlement in the vast timber region of what is now Ontario (Macdonald 1934).

According to A.J. Russell (1867), Inspector of Crown Timber Agencies in Ottawa, "the lumber trade of Canada owes its commencement to contractors for the supply of the Royal Navy Yards of England". This was logically extended to the harvest of timber for ordinary sale and exportation.

By 1805, the river technique had been mastered, including the construction of rafts and knowledge of the river's channels (Lower 1933). Rafts of timber were commonly descending the "Longue Sault" Rapids near Cornwall (Boulton 1805).

Philemon Wright, who is recognized as the pioneer of the Ottawa Valley timber trade (Defebaugh 1906, Whitton 1943), felled the first tree on his homestead on March 7, 1800. This is the site where the City of Hull was later founded. In 1806, Wright took the first raft of square timber from the Ottawa-Gatineau region, down the Ottawa and St. Lawrence rivers to Quebec; two years later he built his first sawmill and gristmill. Wright was later elected the first member of the Canadian parliament to represent the Ottawa region.

The timber trade on the lower Ottawa River began several years earlier at Hawkesbury. The Hawkesbury Mills were founded in 1802 by Thomas Whitlock of the Seigniory of Argenteuil; purchased a few months later and completed by Nathaniel Hazard Treadwell; transferred in 1805 to a partnership of Thomas Mears and Dr. David Pattee; sold to William Henry Hamilton in 1807; and later became the largest sawmill in the British empire (Byers 1981).

Data on the timber trade between the North American colonies and the United Kingdom were presented to the Great Britain House of Commons Select Committee on timber duties in 1835. Figure 1 presents these data, comparing

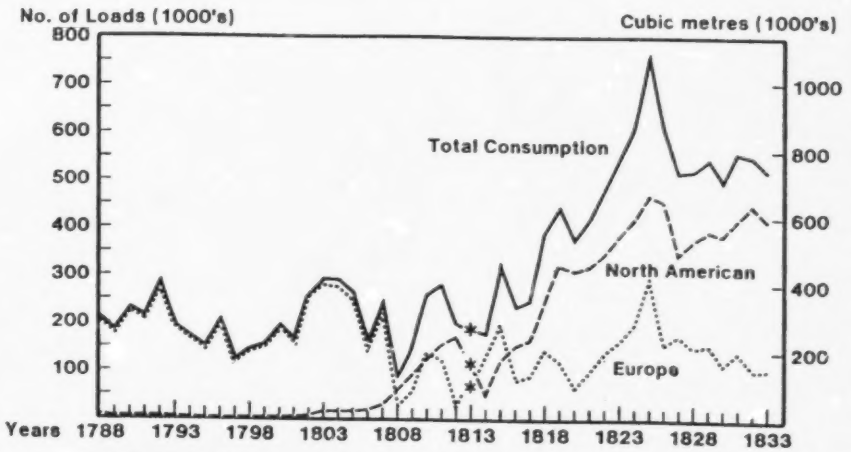


Figure 1: An account of timber consumed in the United Kingdom from 1788 to 1833, showing the quantities imported from the North American colonies and from Europe (1 load = 50 cubic feet). * No data available.

quantities of timber imported from the North American colonies and Europe.

Prejudice against colonial timber

Initially, there was a prejudice against the quality of colonial timber. Red pine was preferred over white pine because of its similarity to the Scots pine of Europe (*Pinus sylvestris* L.). The eastern white pine of North America, called yellow pine or Quebec pine in Europe, was considered vastly inferior — much softer, not durable, and very liable to rot. It was said that if the price of Baltic and North American timber were the same, the latter would never be used, except for some temporary purpose (White 1899).

Stewart Thayne, a witness to the British Select Committee on timber duties (1878), reported:

". . . strong prejudices existed against Canadian wood in England at one time. A constructor of the royal navy stated before a parliamentary committee that a ship constructed of colonial timber could not be depended on for more than twelve months, on account of its partiality to the dry-rot. Builders came forward on the same occasion to allege that a house having a covered beam of Canadian pine was dangerous to human life, because it might cave in at any moment, while there were some who did not hesitate to maintain that a building containing any portion of this despised wood would speedily become uninhabitable, owing to its tendency to breed bugs" (Hough 1880).

The dominance of the red pine harvest, compared with eastern white pine, is evident in the early accounts of timber cut. The duties collected for 1828 at the Chaudiere Falls, Bytown, set the piece count at 28,208 red pine to 67 white pine. By 1844, the piece count was almost equal, and the white pine harvest represented 50% more volume.

In 1832, the price for red pine was 10 pence per cubic foot, with white pine at 4 pence. It was not until 1868 that square white pine commanded a higher price than red pine (Wade 1913). By this time, the production of white pine was substantially greater and both had passed their peak year (Figure 2).

Early trade with the United Kingdom

While Baltic timber had a price advantage over North American timber, due to its shorter transportation route, this advantage decreased with each increase in the duty on foreign timber. Colonial timber, on the other hand, was admitted free until 1798, when a nominal charge was levied and then removed in 1806 (Hough 1880). Discrimination against North American timber was lessened in 1803 when, to help offset the cost of the war with France, Britain imposed a 25% increase in the duty on foreign timber.

Figure 1 clearly illustrates the impact of the crisis of 1808-1809 on the shipment of timber, as described by Albion (1926) and Lower (1973). As Napoleon conquered Europe, he closed the rivers and ports to trade with Britain. In 1808, by agreement with the Czar of Russia, all the Baltic ports were closed to British trade. Traffic through the Baltic Sound, estimated at

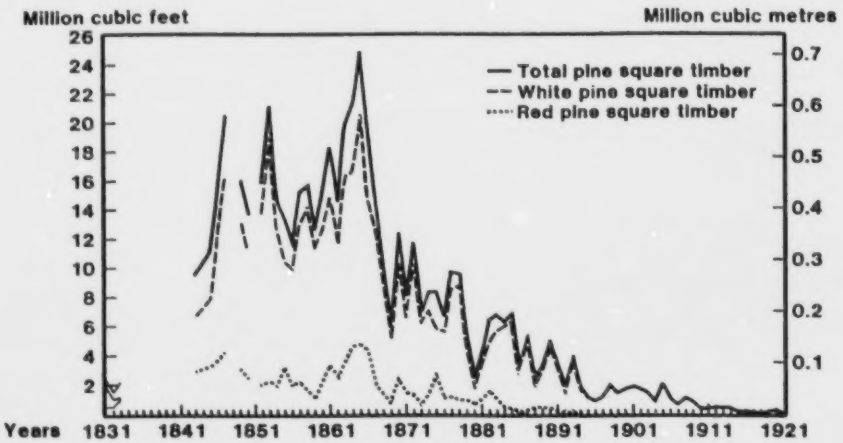


Figure 2: Annual harvest of white and red pine square timber from Ontario's Crown forest

approximately 10,000 vessels per year, was reduced to 121 vessels that year. The crisis ended two years later when Russia reopened its ports, but this brief interlude provided a great impetus to the trade in North American timber.

Further stimulus was provided when the British duty on foreign timber doubled in 1811, and advanced again in 1813. The tariff advantage stimulated the North American timber trade, at the expense of the Baltic trade.

During the 1812-14 period, Great Britain was at war with the United States, thus decreasing the availability of ships for trade with the colonies. By the end of this war and the war with France in 1815, the British North American colonies had established themselves as a timber exporting region. Production more than doubled over the next 3 years. Discrimination against North American timber had been overcome, effective avenues of commerce had been established, ships were available for transportation and Britain was experiencing a period of economic expansion.

There was a setback in 1819, due to a cholera epidemic in the colonies, followed by a post-war depression. Another productive period ended with the crash of 1825-27. But after 1828, the improvement in trade confirmed the North American colonies as the major supplier of timber to the United Kingdom.

The pine trade and Confederation

The peak year for Ontario's square pine trade was 1864, just 3 years prior to Confederation (Figure 3). That year, about 25 million cubic feet of pine were floated down the Ottawa and St. Lawrence rivers to the Port of Quebec, for export to Britain. Shipbuilding activity at Quebec also peaked in 1864, perhaps because timber-carrying ships formed a large part of the trade. At least 2,500 ships were built at Quebec between the beginning of British rule in 1763 and the close of the 19th century (Leacock 1944).

At the time of Confederation, it was obvious that Ontario and Quebec were intimately linked by the timber trade. The two provinces had learned to cooperate in their trade with Britain, and to protest their dealings with the United States. Just prior to Confederation, the United States terminated the Reciprocity Treaty that had provided for the free exchange of natural products, forcing Canadian wood merchants to seek markets elsewhere. Thus the timber trade did much to strengthen the cause for uniting the provinces and accomplishing Confederation.

Timber gives way to sawlogs

After 1867, the trade in sawlogs increased markedly (Figures 4 and 5), at the expense of the square timber trade. Technological advances in sawmilling made it a better "deal" to process the entire log into lumber, rather than chop it into square timber. The market gradually shifted from the square timber trade with Britain to a trade in sawlogs with the United States. From 1879, Britain accepted lumber as well and the square timber trade was doomed.

Therefore the decline and collapse of the pine square timber trade was caused by a market shift, not by the overcutting of

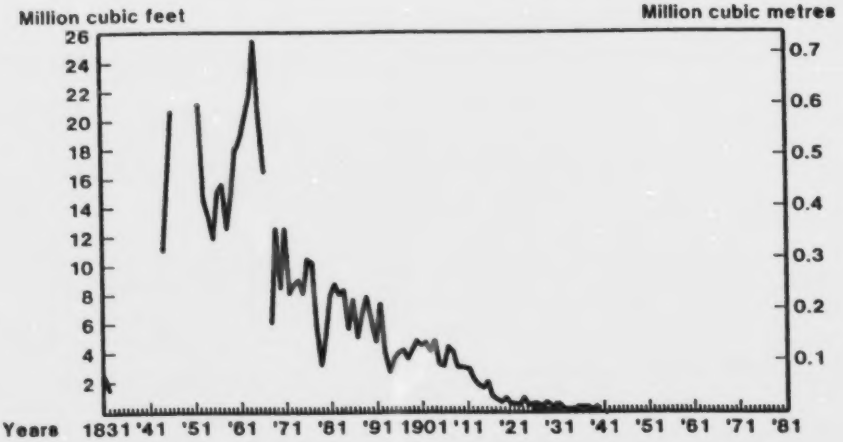


Figure 3: Annual harvest of white and red pine square, waney, boom and dimension timber from Ontario's Crown forest

large trees. In fact, during the period 1869 to 1878, when a significant decline in the square timber harvest occurred, the volume per piece of square timber averaged 55.5 cu.ft., which represents timber 19 in. by 21 in., by 20 ft. long (Eaton 1905).

The growing settlement in the eastern United States had depleted local pine through logging and fire, creating new markets for Ontario pine. New York became a major importer of Ontario's lumber, and Michigan imported logs to saw for the Chicago market.

During the 1890s, as much as one-third of Ontario's pine sawlog production was exported in huge rafts to sawmills in Michigan, Wisconsin, and Minnesota (Burgar 1983). The peak year was 1896 when much wood was rushed south across the border in anticipation of a new U.S. import duty. That year, sawlog production hit a level five times higher than the peak level set for square timber 32 years earlier.

In 1897, the United States imposed a tariff on the importation of lumber, and threatened to raise the duty by an equivalent amount if Canada imposed an export duty. This was reflected in a dramatic drop in sawlog production (Figure 6). "The Dominion Government could not act on account of the retaliatory clause, which would have only made matters worse for the lumberman" (Lower 1938).

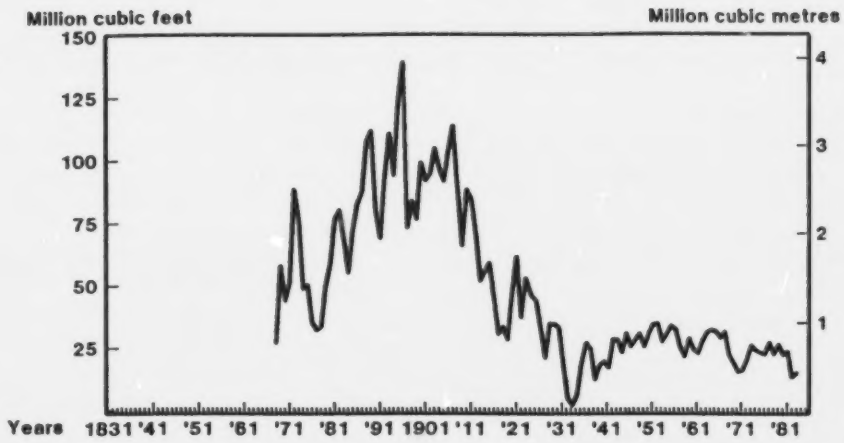


Figure 4: Annual harvest of white and red pine sawlogs from Ontario's Crown forest

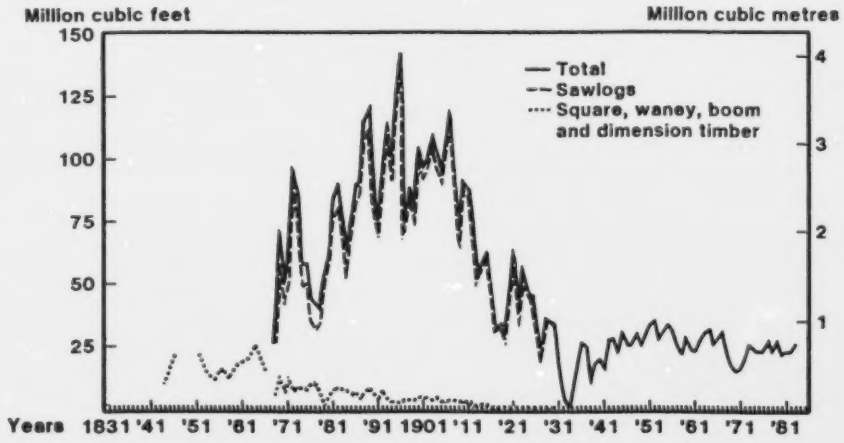


Figure 5: Annual harvest of white and red pine timber (square, waney, boom and dimension) and sawlogs from Ontario's Crown forest

However, the following year, the Ontario government responded by prohibiting the export of sawlogs harvested on Crown lands. This new legislative policy was enforced by placing rangers and their assistants at the mouths of the various rivers from the Matchedash River to Sault Ste. Marie. "This work entailed considerable expense, but as an object lesson of Ontario's intention it has had an excellent effect" (Report of the Commissioner of Crown Lands, 1899).

Permission was granted to continue the export of wood cut in the winter of 1897-98, including wood temporarily left in the woods or hung-up in the streams. This accounts for the 2-year delay before the export of sawlogs to the U.S. ended in 1900.

At the turn of the century, the wealth of the pine forest reached its peak and the annual harvest was near its highest level. All logs harvested on Crown lands now had to be sawn in the Dominion of Canada. New mills were built, new towns established, new jobs created — and new value added to the end product.

But the annual pine harvest gradually fell, for a variety of reasons: a smallpox epidemic in 1901, the serious shortage of labour during the war of 1914-18, the general depression that followed in 1921, and the great depression of 1930-35, when production hit an extreme low. But the chief reason was the dwindling supply of virgin pine.

The 19th century loggers removed the prime pine first, returning some years later for a second cut. Throughout most of the present century, we have been harvesting a new crop.

Today, the eastern white pine and red pine sawlog production fluctuates about a level equivalent to that of the peak year of the square timber trade.

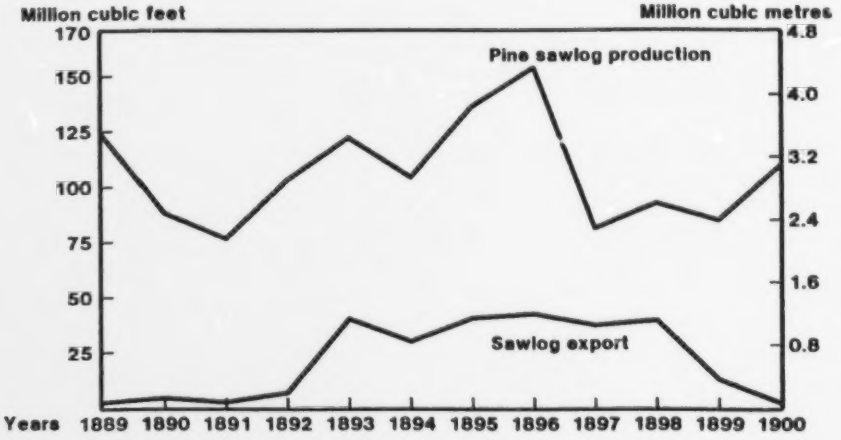


Figure 6: The production of pine sawlogs in Ontario and the export of sawlogs from Ontario to the United States, in relation to the 1898 regulation requiring all logs harvested on Crown lands to be manufactured in Ontario

Timber, deals, planks and boards

Pine timber and deals were the major wood products exported from Ontario in early times. The term "timber" referred initially to wood square-on-four-sides; it was known later as "square timber".

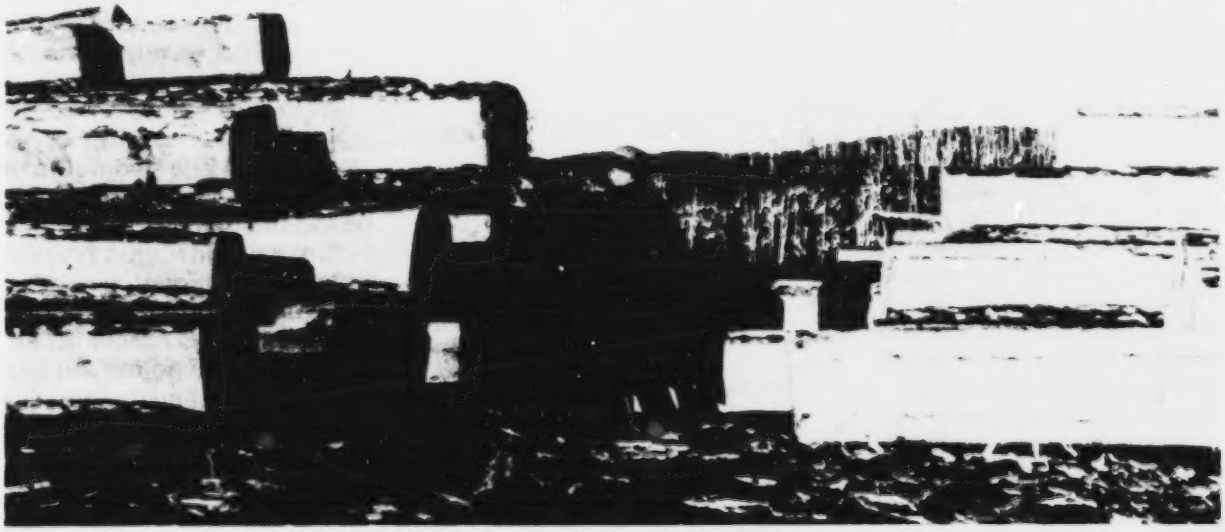
Timber from the Baltic region of Europe was "die-square", meaning square throughout its length. For North American timber, a taper of up to 1½ in. for 20 ft. of white pine, and up to 2 in. for 25 ft. of red pine, and in proportion for greater lengths, was acceptable (Victoria Reginae 1845).

The first records for production of waney timber appeared in Canada West in 1861. Waney timber had four square faces, with the corners bevelled or left rounded, and was roughly octagonal in shape, which increased the yield of wood from each log. Flatted timber had only two opposing faces, flat-hewn or sawn.

Waney and flatted timber were less wasteful than hewing the timber square. The waney logs usually came from the lower part of the tree, so they were of large dimension and excellent quality. This accounts for the 20 to 30% higher prices paid for waney timber compared with square timber (Anon. 1913).

Pine deals were an important export product from early sawmills. They were planks, of varying lengths and widths, but with a thickness limit of 3¼ in., "the quarter of an inch being given as ample measure for three inches". The distinction between deals and planks was primarily based on quality. A deal was a plank of high quality, suitable for resawing. A board was usually less than 2 in. thick.

Initially, the square or waney timber imported into Britain was used directly, or sawn into beams, rafters and quartering, but rarely into thin boards. Boards cut in Britain from timber squared in the colonies was considered of little value. "The deals cannot be sawn in this country, they must be sawn abroad. The timber would not come in the state fit for sawing" (Great Britain House of Commons 1835).



Waney timber, 1925 Courtesy Ontario Archives (Reference S I 3255)

Measuring the harvest

Not long after the pine timber harvest began, it was obvious that some form of measurement and regulation was required. Traffic from Upper Canada through the St. Lawrence River rapids was growing. There were instances of loss of life and property. Delays were common, caused by hang-ups of overloaded water scows and oversize timber rafts.

An act, proclaimed in Lower Canada in 1801 (45 George III), appointed an inspector and measurers to: measure the depth of each water scow and timber raft; force a load to be lightened, if required as a safety measure; and charge fees, based on the number and length of timber rafts.

The measurement of timber was refined three years later with "an Act for the better regulation of the Lumber Trade" (48 George III). By this time, lumber was recognized as important in the export trade. It was believed that the reputation of Canada's lumber would increase if the quality and measurement were properly ascertained.

According to this act, no lumber was to be exported unless it had been culled, measured and certified as to quality. The merchantable quality of square pine timber was defined as not less than 20 ft. in length and 12 in. square, free from rot, bad knots, shakes and other defects, and properly squared and butted. The British imported such timber by the "load" of 50 cu.ft., equivalent to 1 ton.

Under the licenses granted by the Home Government, early lumbermen were not charged for the volume of timber harvested. Since theft had become common, dues were introduced in 1824 as a measure to control the logging on Crown lands. A collector of Crown timber dues was appointed to levy timber at the rate of a halfpenny a foot for red pine, and to sell the timber of parties who would not pay (Russell 1867).

On the Ottawa River, dues were levied on the actual measurement of the quantity taken out by the license holder. Afterwards, when that system was found to cause too much delay, the pieces in each raft passing Bytown were counted. Each stick of white pine timber was estimated at 70 cu.ft., red pine at 38 cu.ft., and all other kinds of wood at 34 cu.ft. (Russell 1867). In other parts of the province, the license holder's own statement as to the quantity of timber cut was accepted.

Keeping the accounts

The first collectors of dues kept excellent records, as evidenced by the accounts and statement books held by the Ontario Archives. While the accounts for 1828 applied only to the Upper Ottawa region, upstream of Bytown, data for 1831 and 1832 were broader in scope, relating to the Eastern, Ottawa, Newcastle, and Midland districts (Journals of the House of Assembly, 1831-32). These are the earliest data used in this report.

The Supervisor of Cullers' Office in Quebec issued annual reports of wood received for export. The earliest available report, dated 1844, is printed in the Journals of the Legislative Assembly. The Journals also included annual reports for 1845-46, 1850 and 1852-55. Further statistics on the pine harvest in Ontario can be found in the annual Report of the Commissioner of Crown Lands of Canada, 1856-66, and of the appropriate Commissioner or Minister in the Province of Ontario, 1867-1983.

Reliability of data

The statistics and graphs presented in this report refer only to the harvest of trees from the Crown forests of Ontario, including pine trees harvested from Crown land and the harvest of pine trees that were reserved in the right of the Crown on private lands. They do not include the harvest of pine trees from patented or privately owned lands because of limitations in the availability of data.

In his report in 1856, Joseph Cauchon, Commissioner of Crown Lands, thoroughly described how the Crown Lands were organized and administered. Prior to 1852, the timber trade was conducted by local Crown Land Agents, a system that was considered defective, with many abuses in the collection of dues, including much timber harvested without paying, and other frauds. In fact, the revenue from the timber harvest doubled in 1852 with

the creation of the Woods and Forests Branch, Department of Crown Lands of Canada. Hence, statistics prior to 1852 are considered questionable.

Despite the Commissioner's suggestion that the Crown land reports from 1852 on are accurate, Hough (1880) presents another view:

"With respect to the credibility of the Crown Lands reports . . . we should remember that they in part represent the amount of taxes collected upon the timber taken from these lands, and we therefore see a motive for rendering the returns below the actual production, while there would never be found a reason for placing them above. They present, in fact, the amount that did not escape the notice of the revenue officers. We are not justified in expressing any opinion as to whether the amount reported be relatively large or small, as compared with the actual production, but may be in all probability somewhere below the truth."

The statistics of exportation were not liable to the same criticism, because no export duties were paid. Likewise, the amount of forest products passing the government slides, and through the canals, was probably reported close to the exact amount, since each transaction was under the immediate notice of officials present.

Treatment of data in this report

Data on square and waney timber were commonly reported in number of pieces and cubic feet. These data were used unadjusted.

Data on boom and dimension timber run from 1868 to 1939-40. They peak between 1888 and 1908, when the rivers and streams were improved for driving sawlogs and pulpwood, and the harvest of white and red pine sawlogs were at their highest level. These data were listed in standards, containing 200 board feet, and in board feet. These figures were adjusted, using 12 board feet per cubic foot, since timbers were usually used in large dimensions.

Records of waney timber production extended from 1861 to 1867, after which they were included in the sawlog data, though there were limited data on waney timber until 1936. Data on masts, bowsprits, spars, flatted timber, deals, planks, and boards lacked continuity over the years and often could not be separated by species, and were therefore ignored in this report. In addition, data on the total production of deals, planks, and boards by species were not available after 1867.

In contrast with the almost continuous account of square pine production by species, there are gaps in the data for sawlogs. For example, the white and red pine sawlog data were combined from 1924-54.

Sawlogs were measured individually by length and diameter. An estimate of board foot content was made by using standard log rules, that made allowances for wood lost as sawdust, slabs, edgings, and board ends.

When the fourth edition of the Scribner Rule was published in 1846 (Graves 1906), it became the official Dominion Government log rule. The Doyle Rule, introduced between 1870 and 1880 (Graves 1906), became the common rule in Ontario in 1879 (Robinson and Honer 1974). It was the official rule in contracts with the Crown many years before the first edition of the Manual of Scaling Instructions listed it as the official rule for Ontario (Ontario Department of Lands and Forests 1943).

The Ontario Rule, developed by the Ontario Department of Lands and Forests in cooperation with the lumber industry, replaced the Doyle rule in 1952 (Report of the Minister of Natural Resources of the Province of Ontario, year ending March 31, 1953).

Data on sawlogs were variously reported in "standards" (each "standard" log containing 200 feet board measure), in feet board measure, in equivalent cubic feet and in equivalent cubic metres. The "equivalent" measure included estimates of the additional wood removed in saw kerf, slabs, edgings, and board ends.

After the introduction of the Ontario rule, provincial practice for statistical purposes only, not for the payment of Crown dues, was to use 5.35 as the board-foot conversion ratio for species of small diameter such as jack pine, and 5.88 for species of large diameter such as eastern white and red pine.

Sawlog data from 1942 to 1983 were reported in equivalent cubic feet or cubic metres and were used directly in this study. Data between 1891, the beginning of pulpwood records, and 1941 were reported in feet board measure and converted to equivalent cubic feet, using a conversion ratio of 5.88 for white and red pine. A conversion of 6.5 was used prior to 1891 to adjust for the larger diameter of the logs harvested.

Prior to Confederation in 1867, the harvest data for Ontario and Quebec were combined. However, the data were presented in sufficient detail to make a realistic separation. For example, the data for "Ottawa, and its tributaries, above Bytown" were tabulated separately for 12 different watersheds, and realistic adjustments were made, based on the location of the watershed in Quebec or Ontario.

The fiscal year of record ended on different dates, such as December 31, October 31, and March 31. The reporting year throughout this report has been the year with the greatest number of months included. For example, data presented for the year ending March 31, 1950, were recorded as 1949 data. Data for 1867 were reported for only part of the year and were therefore omitted.

Raft of square timber on Ottawa River below Deux Rivière Courtesy Ontario Archives (Reference S 1889)

White pine stand

Managing the pine forests

Perhaps the first attempt to regulate the pine harvest in Ontario occurred in the early 1800s when a commission, comprised of a sailing Master of the Navy, a gentleman from the Royal Dock Yards, and a member of the Crown Land Department of Upper Canada, was sent up the Ottawa River. Their instructions were to determine if all the eastern white pine trees would be required as masts for the Navy, with the view to stopping the lumber trade if there were no more than needed for that purpose. "After some abortive attempts to ascertain the resources of the Ottawa Country by running some straight lines, a few chains into the woods, they came to the concluion that there was plenty of Pine in the country for all purposes" (Russell 1867).

The Hon. Jas Skead of Ottawa conducted a more thorough survey in 1865 (Johnson 1895). He divided Ontario into districts and described the richness of the forest in each. The Valley of the Ottawa was described as "the principal site of the lumber trade. . . It possesses white and red pine, both of the largest and best on the continent." According to the information he presented, about one-third of the pine in the Ottawa Valley area was harvested by 1865.

The tremendous increases in Ontario's annual pine harvest from 1867 to the end of the century led to expressions of alarm at the escalating rate of forest destruction. In 1871, Sir John A. Macdonald, Prime Minister of Canada, addressed the following letter to the Hon. John Sandfield MacDonald, Premier of Ontario:

"My dear Sandfield,
The sight of the immense masses of timber passing my windows every morning constantly suggests to my mind the absolute necessity there is for looking at the future of this great trade. We are recklessly destroying the timber of Canada and there is scarcely the possibility of replacing it. The quantity of timber reaching Quebec is annually decreasing and the fires in the woods are periodically destroying millions of money. What is to become of the Ottawa region generally, after the timber is cut away, one cannot foresee. It occurs to me that the subject should be looked in the face and some efforts made for the preservation of our timber. The Dominion Government, having no lands, has no direct interest in the subject, but it seems to me that it would be a very good thing for the two Governments of Ontario and Quebec to issue a Joint Commission to examine the whole subject and to report: 1st. As to the best means of cutting the timber after some regulated plan, as in Norway and the Baltic: 2nd. As to replanting so as to keep up the supply as in Germany and Norway, and 3rd. As to the best way of protecting the woods from fires."

In 1876, James Little of Montreal published a pamphlet on the timber supply (Johnson 1895). He reported that the rich commercial woods of pine, oak, walnut, ash, elm, and white wood in southwestern Ontario were all but gone.

"We now reach the valley of the Ottawa which is the only pine timber we have worth giving a moment's consideration to in discussing the question of supply, and yet, from the information I have obtained on the subject from those whose lives have been mostly spent in the territory, I have every reason to conclude that at the rate of consumption going on a single decade will be sufficient time to totally exhaust its resources."

A year later, the Hon. H.G. Joly presented a report to the Minister of Agriculture on the state of Canada's forests (Hough 1880). He reported that the forests had been overrun, robbed of their finest pine, and left seriously impoverished. He expressed concern about a reduction in wood quality (Little 1886): "If there is no sign of exhaustion, what is the meaning of the complaints that come over the seas to us, every year louder and louder, about the falling off in quality and size of our pine, hitherto considered as the finest in the world?"

To illustrate the decline in log size, Johnson (1895) presented an analysis of the cullers' returns at Quebec and other St. Lawrence ports. He attributed the decreased size, and consequent decreased quality of white pine, as the chief reason for the decline in demand from the United Kingdom.

Description	Average cubic feet per piece						
	1865	*1870*	*1875*	*1880*	*1885*	*1890*	*1893*
Waney white pine	80	56	57	61	57	58	58
Square white pine	66	55	57	55	52	44	44
Square red pine	59	39	37	39	38	39	39

The Timber Trades Journal (1897) reported on a conversation with Johnson which provided another perspective:

"Much of the timber and many of the logs now used would not have been touched by the lumberman in former years. Also when a tree was felled in many cases only one log was taken, and the smaller end of the tree discarded, but now two or three logs will be taken to the mill from such a tree, and, of course, the top logs being used, a smaller average will result."

In 1878, a Select Standing Committee on Immigration and Colonization of Parliament instituted inquiries into the condition of the forests of the country and the extent, value, and prospects of the lumber trade (Hough 1880). Stewart Thayne reported that over four-fifths of the square white pine shipped to the United Kingdom was manufactured in the Ottawa Valley. He claimed that the importation of timber into England from Canada had fallen off because so much of the timber was of poor quality. The square timber, which 30 years earlier had averaged from 70 to 75 cu.ft. per log, had fallen to 55 cu.ft. The pine rafts, that had previously contained 70 to 80% first quality wood, had dropped to 20%. In response to an inquiry on the feasibility of replanting denuded timber lands, Thayne replied:

"It is difficult to understand how some steps in this direction have not been taken. In the provinces of Ontario and Quebec, the local governments derive a handsome revenue from the timber lands, and yet they seem to regard their disappearance with perfect indifference. Every tree that is felled contributes to their exchequers, still millions have been destroyed by fire without exciting the least effort to prevent such wholesale destruction."

Fire prevention

The destruction of the forest by fire was proportionate to the advancement of roads, railroads, settlements, logging, fishing, hunting, and mining exploration. The Ottawa Valley timber baron J.R. Booth (1827-1925) estimated that for every tree harvested, 20 more were destroyed by fire (Coons 1978).

"An Act to Preserve the Forests from Desruction by Fire" was enacted by the Ontario government in 1878. It established precautions to be taken when clearing land, cooking, using locomotives, travelling or working in the woods. A major conservation measure, this act led to the development, 7 years later, of a fire ranging system designed to detect and suppress forest fires.

In 1883, the Rt. Hon. Earl of Derby, K.G., Secretary of State for the Colonies, sent a despatch to the Governor-General requesting information "on the subject of the proximate exhaustion of the forests so far as the question relates to the Dominion of Canada." A parliamentary paper titled "Reports on the Forests of Canada", which combined the replies from the lieutenant-governors of the various provinces on the subject, was presented to both the British and Canadian Houses of Parliament, by Command of Her Majesty, in April, 1885.

The report from Ontario was prepared by R.W. Phipps, the first Clerk of Forestry (Lambert and Pross 1967). It provided new perspectives on forest inventory, forest growth and the prevention of forest fires:

"With regard to the duration of the timber supply of the Dominion of Canada, no accurate calculation can be made, as no data exist whereby to determine the amount of merchantable timber standing in the forest area. To obtain this would require surveys more extensive and costly than any which have yet been attempted . . .

"For many years past statements have been made concerning the possible exhaustion of Canadian forests, and

very diverse opinions have been expressed on the subject by persons of apparently equal experience and knowledge. It appears to me that when it has been stated that there is but five or there is but ten years' supply remaining, this may fairly be understood to refer to the possibility of obtaining timber of the same sizes as we have hitherto cut. It is probable that over a great extent of this territory many of the largest trees have been taken out. But it should be remembered that the forest has great reproductive power, that young trees continually replace the old, and that in 20 years' time trees now but of medium size will furnish excellent timber. The duration of our timber supply also largely depends on the measure of care to be taken in the future in the preservation of our wood lands. For many years little or no pains were bestowed in this matter, and throughout large districts, the settler having followed the lumberman, the field took the place of the forest. The ravages of forest fires, too, have in many places greatly injured our timber lands. Of late years more attention has been paid, and it is probable that throughout all the provinces active measures will shortly be taken for the preservation of the forests. These measures, it is likely, will include the setting aside of large districts for forest purposes, and the regular maintenance of officials charged with the duty of preventing the occurrence of fires. The Ontario Government have been active in prosecuting inquiries concerning this important subject, and further legislation thereon may immediately be expected. Undoubtedly if the careless methods of lumbering pursued in former years were to be still continued, no means of forest preservation adopted, nor any methods employed to prevent the ravages of fire, the duration of the Canadian timber supply would be greatly lessened. But this is not likely to be the case, public attention having been called to the necessity of a more careful method of procedure. In my opinion there is no doubt that if care be taken of the remaining forests of Canada a very large portion of them will continue in a perpetually reproductive condition, capable of furnishing an annual yield equal to the present yearly cut."

Pine silvics

While the potential to manage Ontario's pine for sustained production was recognized more than a century ago, the knowledge to do so was limited. It was not until 1896 that Pinchot and Graves published "The White Pine. A Study with Tables of Volume and Yield". The first systematic description of the growth of a North American tree, it included both silvicultural notes on the natural history of eastern white pine and tables for estimating volume and yield.

This was followed by the publication of a monograph on the eastern white pine of the northern United States (Spalding and Fernow 1899). The object of the monograph was "to lay the basis for an intelligent recuperation of the virgin growth by the forest grower of the future, work which will surely be begun presently, but which would not have been undertaken ten years ago."

Forest reserves

The primary focus during the 19th century was to encourage the settlement and agricultural development of Ontario. Logging was regarded as a secondary activity to clear the land for agriculture and to provide the forest products needed to sustain the growing settlements (Aird 1976).

Crown land was deliberately converted from forest to farm until 1893, when the report of the Royal Commission of Forest Reservation and National Park led to the creation of Algonquin Park as the first Crown forest reserve.

The "Forest Reserves Act (1898)" provided the "power to set apart such portions of the public domain as may be deemed advisable for the purposes of future timber supplies." The introduction of Crown forest reserves not only put a brake on the continuous expansion of agricultural land, but also created a permanent, Crown-owned estate to be operated in perpetuity for timber crops (Aird 1976).

Johnson (1895) contrasted the destructive forces of logging and fire with the productive forces of natural regeneration, fire management and Crown reserves. The productive forces, once vastly inferior, were becoming almost as powerful.

Victoria Island, Ottawa: Rafts under construction.

Log rafts were broken into cribs, floated down specially constructed timber slides, and reassembled below the Chaudiere Falls.

Heritage Film Collection, Faculty of Forestry, University of Toronto

Forestry education

Canada's first Faculty of Forestry was established at the University of Toronto in 1907. This followed a recommendation two years earlier by a Royal Commission appointed to report on the affairs of the university (Sisam 1982):

"The value to the country of scientific work in forestry has been already recognized upon this continent, but in Canada little has been done to apply systematically the lessons taught equally by sound economic theory and practical experience. It is surprising that Ontario with its rich areas of timber has hitherto failed to set up a school of forestry in its own university for the double purpose of providing technical training for young men in an important branch of science and of benefitting in the conservation of its forest wealth by their knowledge and skill. It would be difficult to mention a case in which the State's duty and interest go more completely hand in hand . . ."

The Faculty's first dean, B.E. Fernow, prepared a comprehensive analysis of the changing composition of Canada's forests (Fernow 1908, 1912). This directed more attention to the need for better information on the growth and drain of Ontario's merchantable pine species.

Inventory of pine

At the 1904 budget debate of the Ontario legislature, the Hon. E.J. Davis, Commissioner of Crown Lands, admitted that it was difficult to make an exact estimate of standing timber in a province as large as Ontario, and that past estimates had erred on the safe side. "Our general estimate, and this is putting it low, show that we are quite safe to say without any hesitation or doubt at all, that there are unsold in the Crown, belonging to the people of this Province . . . at least ten billion feet of good pine."

In contrast, Fernow (1912) noted that most of the western portion of the St. Lawrence Valley was being farmed, the commercial timber having been cut: "As a timber producer, it is now almost negligible." Likewise, most of the commercial timber in the middle and eastern portions of the Valley had been cut.

Conifers predominated in the Laurentian Region, located just north of the St. Lawrence Valley. Balsam fir was identified as the most numerous species, with white spruce a close second. In the swamps, the "almost useless black spruce" was prominent, along with white cedar and tamarac. White pine and hemlock, "the two most valuable species", occurred with red pine in the more localized areas along the waterways and on the better drained sandy hills.

Although Dean Fernow stated that "anything like statistical knowledge regarding Canadian forest areas is lacking", he suggested that the commercially available and accessible saw timber in Ontario was near the exhaustion point. He also deplored the lack of knowledge of the actual conditions of the timber supply and of the need for more conservation. "Even now, persons in high and responsible positions prate of 'inexhaustible timber resources' — a false patriotism apparently inciting them to boom the country."

The destruction may be illustrated best by the report on forest conditions in the "Trent Watershed Survey" (1913) prepared by Professors Howe, White, and Fernow of the Faculty of Forestry, University of Toronto. They described the original forest on the lower watersheds as being two-thirds a magnificent pinery, or hardwood with white pine admixture, and one-third pure hardwood. "Now, the white pine is all but removed, and, with the exception of 700 acres still virgin, the whole lower watershed is more or less severely culled. The pinery has been burned over at least once and in most places several times." This explains why the cut of pine in the Trent district in 1911-12 was less than 10% of the cut 40 years earlier.

The Trent Watershed Survey, initiated by the Conservation Commission of Canada, was the first organized forest survey in the pine region of Ontario. In 1920, this work was extended into a continuing program of surveys by the province (Richardson 1928). By 1930, the forest resources of Ontario had been surveyed on nearly two-thirds of the 118 million acres under organized protection from fire. Different survey methods were used. Most of the white pine producing areas

Raft with many houses.

Up to 80 people worked on the cribs and rafts floating down the Ottawa River.

Heritage Film Collection, Faculty of Forestry, University of Toronto.

were surveyed using methods to determine forest type and age-class distribution, without estimating the volume of timber present (Sharpe and Brodie 1931).

More detailed forest surveys, conducted between 1946 and 1959, were summarized in a report by R.M. Dixon (1963). At that time, eastern white and red pine represented about 4% of the total wood volume standing in Ontario, and 15% of Ontario's wood harvest.

Annual allowable cut

Dixon (1963) estimated the annual allowable cut, based on the volume of primary growing stock and the rotation period adopted for each species. The annual allowable cut for all species on Crown lands was estimated at 1.7% of the primary growing stock, or 24 cu.ft. per acre from the productive forest area.

The annual allowable cut for eastern white pine and red pine was estimated at 46.1 million cu.ft., compared with the estimated annual cut of 70.5 million cu.ft. The conclusion was that the annual harvest of eastern white and red pine exceeded the annual allowable cut in the early 1960s.

However, this conclusion, based on an annual cut of 70.5 million cu.ft., appears to be in error. The Minister of Lands and Forests reported an annual cut of less than half that amount for the same period (Figure 5). In other words, the annual harvest did not exceed the annual allowable cut.

According to recent unpublished information from the provincial Ministry of Natural Resources, the annual allowable cut for eastern white and red pine during the 1981-82 season was 1 220 000 cu.m. (43.1 million cu.ft.), compared to the actual cut of 756 000 cu.m. (26.7 million cu.ft.). These estimates suggest that Ontario could increase its eastern white and red pine harvest by about 60%, without exceeding the annual allowable cut.

Pine management research

The Ontario Ministry of Natural Resources, the Canadian Forestry Service, and their predecessors, have devoted much effort to the research and management of eastern white and red pine. For example, in 1960, the federal government published a significant technical note on the ecology of white and red pine in the Great Lakes-St. Lawrence Forest Region (Horton and Brown), plus a comprehensive monograph on the ecology, silviculture and management of white and red pine (Horton and Bedell). In 1977, the federal and provincial governments jointly sponsored and published the proceedings of a symposium on current knowledge of white and red pine management (Cameron 1978). In 1983, the Ministry of Natural Resources published a silvicultural guide to the white pine working group (Scott).

These, and contributions from university research and others, indicate that we have learned how to manage eastern white and red pine to sustain or enhance the production of quality timber. What we have lacked, more than anything else, is the political direction to manage these species for the continuing benefit of both present and future generations.

References

Aird, Paul L. 1976. *Canada's changing policy of creating nature reserves.* Timber Bulletin for Europe, Vol. XXVIII, Supp. 4, Part III: 97-109.

Aird, Paul L. 1978. *Splendor undiminished: A management objective for red pine and eastern white pine ecosystems.* Pages 71-75 *in* White and Red Pine Symposium, Ministry of Natural Resources and the Canadian Forestry Service, Department of the Environment, Chalk River, Ontario.

Albion, R.G. 1926. *Forests and sea power.* The timber problem of the Royal Navy 1652-1862. Cambridge, Harvard University Press, 485 p.

Anon. 1913. *Passing of the trade in square timber.* Canada Lumberman and Woodworker 33(12): 36-38.

Archives Nationales Colonies, *CIIA*, Vol. No. 77, p.54-58, Beauharnois and Hocquart, Oct. 19, 1742 (Reference: Public Archives Canada).

Boulton, D'Arcy. 1805. *Sketch of His Majesty's Province of Upper Canada.* First reprint in 1961, Baxter Publishing Co., Toronto, 91 p.

Burgar, R.J. 1983. *Forest land-use evolution in Ontario's Upper Great Lakes Basin.* Pages 177-193 *in* Flader, S.L. (ed.) The Great Lakes Forest, an environmental and social history, the University of Minnesota Press, Minneapolis.

Byers, William R. 1981. *The church on the hill: A history of Holy Trinity Anglican Church, Hawkesbury, Ontario, and its people.* Holy Trinity Men's Club, Hawkesbury. 235 p.

Cameron, D.A. (Compiler). 1978. *White and red pine symposium.* Proceedings of a symposium, Ontario Ministry of Natural Resources (Toronto) and Canadian Forestry Service, Department of the Environment (Ottawa). 178 p.

Coons, C.F. 1978. *The John R. Booth story.* Your Forests 11(2): 8-26.

Davis, Hon. E.J. 1904. *Ontario's forest wealth.* Ontario Archives Pamphlet No. 27, 16 p.

Defebaugh, J.E. 1906. *History of the lumber industry of America* Volume 1, The American Lumberman, Chicago.

Dixon, R.M. 1963. *The forest resources of Ontario.* Ontario Department of Lands and Forests, 108 p.

Eaton, T. (Co. Limited). 1905. *Eaton's improved lumber and log book.* T. Eaton Co. Limited, Toronto, 189 p.

Fernow, B.E. 1908. *An analysis of Canada's timber wealth.* Forestry Quarterly 6(4): 337-353.

Fernow, B.E. 1912. *Forest resources and problems of Canada.* Proceedings, Society of American Foresters 7(2): 133-144.

Ferguson, Hon. G.H., *et al.* 1923. *Forests and forestry in Ontario.* Special report to the British Empire Forestry Conference, Ottawa. Toronto, Clarkson W. James, 22 p.

George III, Cap. IX, 1805.

George III, Cap. XXVII, 1808.

Government of Ontario. 1893. *Report of the Royal Commission on forest reservation and national park.* Warwick and Sons, Toronto, 278 pp.

Graves, H.S. 1906. *Forest mensuration.* John Wiley & Sons, New York, 458 p.

Great Britain, House of Commons. 1835. *Report from the Select Committee on timber duties; together with the minutes of evidence, an appendix and index.* Ordered to be printed 14 August 1835, No. 519: 465 p. (Reference: Archives Ontario, Imperial Blue Book, Box 3, 1835, No. 519).

Great Britain, House of Commons. 1885. *Reports on the forests of Canada.* Parliamentary Papers, Vol. LXII: 383-419.

Horton, K.W., and **G.H.D. Bedell**. 1960. *White and red pine. Ecology, silviculture and management.* Canada Department of Northern Affairs and National Resources, Forestry Branch Bull. 124, 185 p.

Horton, K.W., and **W.G.E. Brown.** 1960. *Ecology of white and red pine in the Great Lakes-St. Lawrence Forest Region.* Canada Department of Northern Affairs and National Resources, Forestry Branch, Forest Research Division Technical Note No. 88, 22 p.

Hough, F.B. 1880. *The timber resources and timber trade of Canada.* Pages 439-605 *in* Report upon forestry, prepared, under the direction of the Commissioner of Agriculture, in pursuance of an Act of Congress approved August 15, 1876, Volume II, Washington.
Howe, C.D., and **J.H. White.** 1913. *Trent watershed survey. A reconnaissance.* Commission of Conservation, Canada, Toronto, Bryant Press, 156 p.
Johnson, G. 1895. *Report on the forest wealth of Canada.* Appendix to the report of the Minister of Agriculture for 1894, 339 p.
Journals of the House of Assembly. 1831. Ontario Archives reference B57, Reel 2a, Appendix p. 148.
_____. 1831-32. Ontario Archives reference B57, Reel 2a, Appendix p. 132.
Journals of the Legislative Assembly. 1844-45. Ontario Archives reference B41, Reel 4, Appendix K.
_____. 1846. Ontario Archives reference B41, Reel 6, Appendix T.
_____. 1847. Ontario Archives reference B41, Reel 8, Appendix AA.
_____. 1849. Ontario Archives reference B41, Reel 10, Appendix P.P.P.P.
_____. 1851. Ontario Archives reference B41, Reel 13, Appendix L.L.L.
_____. 1853. Ontario Archives reference B41, Reel 17, Appendix G.G.G.G.
_____. 1854. Ontario Archives reference B41, Reel 21, Appendix U.
_____. 1856. Ontario Archives reference B41, Reel 27, Appendix No. 36.
Lambert, R.S., and **P. Pross.** 1967. *Renewing nature's wealth.* Toronto, Ontario Department of Lands and Forests, 630 p.
Leacock, S. 1944. *Canada and the sea.* Pages 1-66, 149-150 *in* Canada's war at sea. Montreal, Alvah M. Beatty.
Little, W. 1886. *Alarming destruction of American forests.* Proceedings, American Forestry Congress, Boston, Vol. IV: 26-35.
Lower, A.R.M. 1923. *A history of the Canadian timber and lumber trade prior to Confederation.* M.A. Thesis, University Archives, University of Toronto, 237 p.
_____. 1928. *The forest in New France.* A sketch of lumbering in Canada before the English conquest. The Canadian Historical Association, Report of the Annual Meeting, Department of Public Archives, Ottawa: 78-90.
_____. 1933. *The trade in square timber.* Contributions to Canadian Economics 6:40-61.
_____. 1938. *The North American assault on the Canadian forest.* A history of the lumber trade between Canada and the United States. Toronto, Ryerson Press, 377 p.
_____. 1973. *Great Britain's woodyard.* British America and the timber trade, 1763-1867. McGill-Queen's University Press, Montreal, 271 p.
Macdonald, N. 1934. *English land tenure on the North American continent: a summary.* Contributions to Canadian Economics 7:21-44.
Ministry of Natural Resources, Ontario, Statistics, Annual Reports 1979-1983.
Ontario Archives, RG 1, E5, Vol. 9, p. 164.
_____. RG 1, E5, Vol. 10, p. 82.
Ontario Department of Lands and Forests. 1943. *Manual of scaling instructions.* First edition. Department of Lands and Forests, Toronto.
Pinchot, G., and **H.S. Graves.** 1896. *The white pine.* A study with tables of volume and yield. The Century Company, New York, 102 p.
Report of the Commissioner of Crown Lands of Canada, Annual Reports 1856-1866.
Report of the Commissioner of Crown Lands of the Province of Ontario, Annual Reports 1867-1904.
Report of the Minister of Lands, Forests and Mines of the Province of Ontario, Annual Reports 1905-1922.
Report of the Minister of Lands and Forests of the Province of Ontario, Annual Reports 1923-1972.
Report of the Minister of Natural Resources of the Province of Ontario, Annual Reports 1973-1978.

Richardson, A.H. 1928. *Forestry in Ontario.* Ontario Department of Forestry, 73 p.
Robinson, J.M., and **T.G. Honer.** 1974. *Without fear or favour: An account of wood measurement in Canada.* Forest Management Institute, Canadian Forestry Service, Department of the Environment: 207 p. + appendices.
Russell, A.J. 1867. *Historical memorandum, on the management of the Crown timber Forests and of Crown Lands connexion therewith.* Ontario Archives reference RG1, F-I-8, Volume 37, 89 p.
Scott, J.D. 1983. *A silvicultural guide to the white pine working group.* Ontario Ministry of Natural Resources, 30 p.
Sharpe, J.F., and **J.A. Brodie.** 1931. *The forest resources of Ontario 1930.* Ontario Department of Lands and Forests, 60 p.
Sheehy, G.W. 1980. *White pine nature reserves in Algonquin Provincial Park.* Master of Science in Forestry thesis, Faculty of Forestry, University of Toronto, 299 p.
Sisam, J.W.B. 1982. *Forestry and forestry education in a developing nation.* A Canadian dilemma. Faculty of Forestry, University of Toronto, 167 p.
Spalding, V.M., and **B.E. Fernow.** 1899. *The white pine.* U.S. Department of Agriculture, Division of Forestry Bull. No. 22, 185 p.
Stiell, W.M. 1978. *Characteristics of eastern white pine and red pine.* Pages 7-50 *in* White and Red Pine Symposium, Ministry of Natural Resources and the Canadian Forestry Service, Department of the Environment, Chalk River, Ontario.
Timber Trades Journal. 1897. *The wood industries of Canada.* Timber Trades Journal, London: 102 p.
Victoria Reginae, Cap. XLIX, 1845.
Wade, E.H. 1913. *A new competitor for white pine.* Canada Lumberman and Woodworker, August 15: 117.
White, Aubrey. 1899. *A history of Crown timber regulations from the date of the French occupation to the year 1899.* Annual Report of the Clerk of Forestry for the Province of Ontario 1899. p. 148-284.
Whitton, C. 1943. *A hundred years a-fellin'.* Gillies Brothers, Limited, Braeside, Ontario, 172 p.